Management of Tick Bites and Lyme Disease During Pregnancy

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Abstract

Lyme disease results from the bite of a black-legged tick, populations of which have now become established in parts of Nova Scotia, southeastern Quebec, southern Ontario from the Thousand Islands through the geographic regions on the north shore of Lake Ontario and Lake Erie, southeastern Manitoba, and British Columbia's Lower Mainland, Fraser Valley, and Vancouver Island. It takes more than 24 hours of attachment to transfer the spirochete *Borrelia burgdorferi* to the bitten animal or human. The diagnosis of Lyme disease is primarily clinical, with early Lyme disease characterized by a skin lesion (erythema migrans, a bull's-eye rash), which expands out from the site of the tick bite, and is often accompanied by influenza-like symptoms, arthralgia, myalgia, and fever. These signs and symptoms can present anywhere from three to 30 days after the tick bite. The management of pregnant women with a tick bite or suspected Lyme disease should be similar to that of non-pregnant adults, except that doxycyline, the first line antibiotic of choice, should not be used in pregnant women because of risk of permanent tooth discolouration and possible impact on bone formation in the fetus. An algorithm for the management of tick bites in pregnancy is presented. Clinical, serological, and epidemiological studies have all failed to demonstrate a causal association between infection with *B. burgdorferi* and any adverse pregnancy outcomes regardless of whether maternal exposure occurs before conception or during pregnancy itself.

Résumé

La maladie de Lyme est attribuable à la morsure d'une tique à pattes noires; des populations de ces tiques sont maintenant établies dans des parties de la Nouvelle-Écosse, dans le sud-est du Québec, dans le sud de l'Ontario (de la région des Mille-Îles jusqu'à la rive nord du lac Ontario et du lac Érié), dans le sud-est du Manitoba, ainsi que dans les basses-terres continentales, la vallée du Fraser et l'île de Vancouver en Colombie-Britannique. La tique doit demeurer fixée à l'animal ou à la personne mordue pendant plus de 24 heures pour que s'opère le transfert du spirochète *Borrelia burgdorferi*. Le diagnostic de la maladie de Lyme est principalement de nature clinique; à ses débuts, cette maladie est caractérisée par une lésion cutanée (langue géographique, lésion cutanée annulaire), laquelle s'étend à partir du site de la morsure de la tique et s'accompagne souvent de symptômes pseudogrippaux, d'arthralgie, de myalgie et de fièvre. Ces symptômes peuvent se manifester en tout temps au cours de la période s'étendant de trois à 30 jours à la suite de la morsure de la tique. La prise en charge des femmes enceintes présentant une morsure de tique ou chez lesquelles la présence de la maladie de Lyme est soupçonnée devrait ressembler à celle que l'on met en œuvre chez les femmes n'étant pas enceintes; toutefois, la doxycycline (antibiotique de première intention) ne devrait pas être administrée aux femmes enceintes, et ce, en raison du risque de décoloration permanente des dents et de possibles effets sur la formation des os du fœtus. Un algorithme pour la prise en charge des morsures de tique pendant la grossesse est présenté. Aucune étude clinique, sérologique ou épidémiologique n'est parvenue à démontrer l'existence d'une association causale entre l'infection à *B. burgdorferi* et quelque issue de grossesse indésirable que ce soit, et ce, peu importe si l'exposition maternelle a eu lieu avant la conception ou pendant la grossesse en tant que telle.

Key Words: Tick bite, Lyme disease, infection

Competing Interests: None declared.

Received on April 23, 2012

Accepted on June 25, 2012

J Obstet Gynaecol Can 2012;34(11):1087–1091

INTRODUCTION

Lyme disease is the most common vector-borne disease in North America. It results from the bite of a black-legged tick (Ixodes scapularis and Ixodes pacificus, also known as the deer tick) that is infected with the bacterium *Borrelia burgdorferi*, a species of gram-negative bacteria of the spirochete class.[1] While readily treatable, Lyme disease if not detected or if left untreated can progress with neurological, joint, and cardiac involvement.

In Canada, black-legged tick populations have become established in parts of Nova Scotia, southeastern Quebec, southern Ontario from the Thousand Islands through the geographic regions on the north shore of Lake Ontario and Lake Erie, southeastern Manitoba, and British Columbia's Lower Mainland, Fraser Valley,

and Vancouver Island.[2–5] While the distribution of this hard-bodied tick is currently limited in Canada, these established populations are spreading into other areas of southern Canada by means of migrant wildlife species (i.e., birds and deer), and this spread may be accelerated because of global warming.[3] This tick can also transmit babesiosis and anaplasmosis in Canada and the United States, although it is rare in Canada.

This commentary provides practitioners with information about Lyme disease and an approach to the management of a pregnant woman who presents with a tick bite.

LIFE CYCLE OF THE BLACK-LEGGED TICK

There are many different kinds of ticks, most of which do not affect humans or transmit infections. Hard-bodied ticks are obligate parasites and therefore require a blood meal in each stage of their life cycle (larva, nymph, adult) to reproduce. At each stage, the tick attaches to its host, feeds, then drops off. During the larval or nymphal stage, the black-legged tick prefers small to medium sized mammals (e.g., mice, cats, dogs); birds and larger mammals (e.g., deer, cats, dogs, humans) are the preferred host during the adult stage. Ticks climb on vegetation and wait for a host to brush against them, which most commonly occurs in wooded areas or along the edge of forest patches and adjacent fields where there is high grass and brush.

SURVEILLANCE FOR *IXODES SCAPULARIS* AND *IXODES PACIFICUS*

Clinical suspicion of Lyme disease and recommendations for prophylaxis depend on the presence of infected black-legged ticks. Therefore, surveillance for ticks is an important tool for assessing risk. A person who is bitten should carefully remove the tick using tweezers, grasping the tick as close to the skin as possible, pulling slowly without twisting, rotating, or crushing the tick. After removing the tick, they should wash the site with soap and water or use a household antiseptic or alcohol to clean the area. The date of the tick bite and where it occurred geographically should be recorded. The tick should be saved in a sealable plastic container, and the local Public Health agency should be contacted; speciation and testing for *B. burgdorferi* may be indicated for surveillance purposes.

LYME DISEASE

In general, it takes more than 24 hours of attachment to transfer *B. burgdorferi* to the bitten animal or human. This is because the spirochete resides and replicates in the midgut of the tick, and there is a delay between the onset of feeding and the appearance of infectious spirochetes in the tick's saliva with subsequent transmission to the host.[6] The saliva of the tick is irritating and normally leaves a small red area of reaction at the site of the bite.

The diagnosis of Lyme disease is primarily clinical. Early Lyme disease is characterized by a skin lesion (erythema migrans [EM], a bull's-eye rash; Figure 1), which expands further than 5 cm from the site of the tick bite, and is often accompanied by influenza-like symptoms, arthralgia, myalgia, and fever (Table 1). The diagnostic triad for Lyme disease is EM, fever, and arthralgia. These signs and symptoms can present anywhere from three to 30 days after the tick bite (average 7 days); 30 days is the longest incubation period. If patients develop signs or symptoms of Lyme disease, they should be treated for 14 to 21 days with antibiotics (Table 2). If they do not develop any signs or symptoms, they should be observed; the need for any treatment will depend on the subsequent development of the typical signs and symptoms. If a patient fails to recognize the signs and symptoms, and the disease remains untreated, it can progress to early disseminated Lyme disease with neurological, musculoskeletal, and cardiac involvement. Late disseminated Lyme disease includes central and peripheral neurologic manifestations and Lyme arthritis.

A small red area of reaction at the site of the tick bite frequently occurs in the first three days, but this is not EM and is not indicative of infection. It can be associated with severe itch or inflammation that is usually maximal when first noted and tends to disappear rapidly, like most allergic reactions to bites.

LYME DISEASE AND PREGNANCY

Because *B. burgdorferi* is a spirochete similar to syphilis, there has been concern about the potential for fetal effects. It is well known that maternal syphilis, caused by the spirochete *Treponema pallidum,* may result in congenital syphilis, and it is characterized by fetal/neonatal lesions of the mucosal layers, maculopapular rashes, condylomata, hepatosplenomegaly, anemia, and osteochondritis, among other findings. However, a specific syndrome representing "congenital Lyme borreliosis" does not appear to occur.[7] Clinical, serological, and epidemiological studies have all failed to demonstrate a causal association between infection with *B. burgdorferi* and any adverse pregnancy outcomes.[8] Regardless of whether maternal exposure to *B. burgdorferi* occurs before conception or during pregnancy itself, it does not appear to be associated with fetal death, prematurity,

or risk of congenital malformations.[9] Even documented infection of the placenta with *B. burgdorferi* has not been linked to adverse pregnancy outcomes.[10] Moreover, there have been no reported cases of transmission of *B. burgdorferi* via breast milk.

The management of pregnant women with a tick bite or suspected Lyme disease should be similar to that of non-pregnant adults, except that doxycyline, the first line antibiotic of choice, should not be used in pregnant women because of risk of permanent tooth discolouration and possible impact on bone formation in the fetus. We have developed an algorithm for management of tick bites in pregnancy (Figure 2). For non-pregnant adults, it is recommended that a prophylactic dose of doxycyline be given if a tick has been attached for more than 24 hours in areas in which ≥ 20% of ticks harbour the *B. burgdorferi* (infectivity levels in some tick populations in Ontario are as high as 25% to 40%, but they are much lower in other parts of Canada, including British Columbia where the level is < 1%). One half of the reported cases of Lyme disease in Canada are acquired while travelling outside the country, so Canadians should be aware of the risk of tick bites while travelling to areas such as the eastern United States and Europe where there are high tick infectivity rates. In areas where the proportion of infected ticks is lower than 20%, chemoprophylaxis following a tick bite is not indicated as the probability of infection is very low. In these situations, watchful waiting and treatment of the syndrome of fever, arthralgia, and rash is indicated.

Currently, according to the US Centers for Disease Control and Prevention and the Infectious Disease Society of America Guidelines,[1] when prophylaxis with doxycycline is contraindicated (as in pregnant women or young children), no prophylaxis should be given. This is because there is an absence of data on any other short-course antibiotic regimen and because there is excellent efficacy of antibiotic treatment for Lyme disease if signs and symptoms develop. In a recent meta-analysis it was suggested that a 10-day course of amoxicillin in pregnant patients, starting within 72 hours of the tick bite, was "likely to be effective, although the precise benefit has not been established."[11] However, the authors of this meta-analysis acknowledged that the risk of an allergic reaction to the amoxicillin would be greater than the risk of developing Lyme disease, even in high prevalence areas. Given that prophylaxis is not 100% effective in preventing infection, if antibiotic prophylaxis is used in a pregnant woman it is important to continue to monitor the site of the tick bite for the EM rash and to initiate treatment if it occurs.

Figure 1. Erythema Migrans which appeared six days following removal of a tick

Table 1. Signs and symptoms of Lyme disease

Stage 1 (following initial exposure)	Erythema Migrans (EM)(circular "bull's-eye" rash) (Figure 1)
	70% to 80% of infected people have this presentation
	Site of tick bite after a delay of 3 to 30 days
	Fatigue, chills, fever, headache, muscle and joint pain, swollen lymph nodes
Stage 2 (if left untreated can last up to several months)	Central and peripheral nervous system disorders; Bell's palsy is the commonest presentation
	Multiple skin rashes
	Arthritis and arthritic symptoms, especially in knees and other large joints
	Extreme fatigue and general weakness
Stage 3 (if remains untreated, can last months to years)	Recurring arthritis and neurological problems
	Heart block and myocarditis

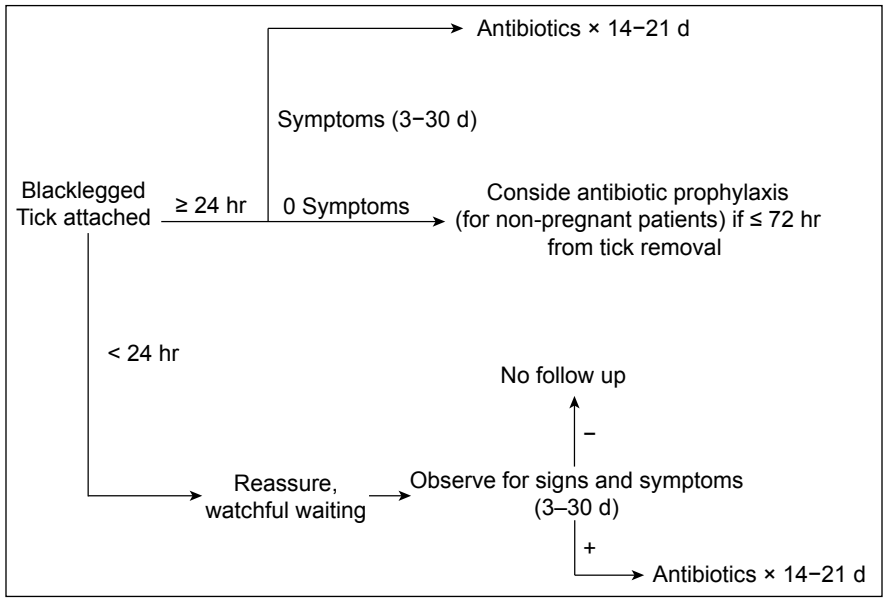
Table 2. Prevention and management of Lyme disease

Treatment[1]		
Stage 1* (Early disease: fever, arthralgia, rash)		
1.	Doxycycline	Contraindicated in pregnancy and lactation
2.	Amoxicillin	500 mg by mouth three times daily for 14 to 21 days
3.	Cefuroxime	500 mg by mouth twice daily for 14 to 21 days
Stage 2 (peripheral neurologic disease or arthritis)		
1.	Amoxicillin	500 mg by mouth three times daily for 28 days
2.	Cefuroxime	500 mg by mouth twice daily for 28 days
Stage 3 (with cardiac, recurrent arthritis or CNS disease)		
1.	Parenteral ceftriaxone	2 g IV OD for 21 to 28 days
Prophylaxis[11] (consider if ≤ 72 hr from tick removal)†		
1.	Doxycycline	Contraindicated in pregnancy and lactation

*Macrolide antibiotics (e.g., Azithromycin, erythromycin) if allergic to those listed. First generation cephalosporins are ineffective.

†Prophylaxis following a tick bite is of questionable value in pregnancy as doxycycline is the only drug demonstrated to be effective for prophylactic use.

Figure 2. Algorithm for management of tick bites in pregnancy



There is an extremely low risk that any person with a recognized tick bite will develop serious complications of Lyme disease.[1] Although the diagnosis of Lyme disease at all stages is clinical, assessment of late disease may be aided by antibody testing for *B. burgdorferi*. As with syphilis, the initial test is an ELISA, with a confirmatory Western Blot analysis. The blood test early in the course of the disease (i.e., at the time of the EM rash) tends not to be helpful, with a moderately high number of false-negative test results, but it is much more likely to be positive once typical arthralgias have occurred.[12] This reflects the fact that IgM- and IgG-specific antibodies take two to six weeks to develop.

PREVENTION

The best way to avoid acquiring Lyme disease is to avoid tick bites. Local public health agencies will be aware of areas where infected black-legged ticks are known to exist. Although the likelihood is low, migratory birds can disperse infected ticks distantly, so suspicion of Lyme disease is indicated everywhere. Everyone should be aware

of the risk for tick bites and Lyme disease when travelling in endemic areas.

When out in wooded or grassy areas, it is important to wear protective clothing, either white or light-coloured, that can be tucked into socks or boots and fits tightly around the wrist. Insect repellents containing DEET are safe for use in pregnancy and can effectively repel ticks when applied to exposed skin and/or clothing. It is important also to perform daily head-to-toe "tick checks," including all hair-bearing areas (groin, armpits, head, etc.), when in areas where ticks are found.[13,14]

ACKNOWLEDGEMENT

The patient whose image is used in this commentary has provided written consent for its publication.

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